

# LOCOMOTION & MOVEMENT.

Simple Movem. → Streaming of protoplasm in unicellular organ. like Amoeba.

★ Some movements → change of place or location. →  
Such Voluntary movem. → Locomotion.

↓  
These struct. need not be diff. from those affect. other types of movements.  
examples →

Paramecium → Cilia helps in movem. of food through Cytopharynx  
Locomotion too

Hydra → Tentacles for capturing its prey  
Locomotion too

All locomotions are purposeful but all movements are not locomotion.

Locomotion needed due to habitat/demand of situation.

Types of Movement :

Amoeboid, Ciliary, Muscular (shown by cells in human body)

Food, shelter, mate, suitable breeding grounds, fav. climatic condition, escape from enemies.

Amoeboid: Specialized cells like macrophages, leucocytes

Effected by pseudopodia due to streaming in protoplasm (as in amoeba)

Cytoskeletal elements like microfilaments are involved.



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Ciliary → internal tubular organ lined by ciliated epithelium

Trachea: Co-ord. movem. of cilia helps in remov. dust & foreign subst. that might have entered.

Female Reproduct tract: Passage of ova through this part is facilitated by ciliary movem.

Muscular → limbs, jaws, tongue

Contractile property of muscles.

Locomotion requires a perfect Co-ordinated activity of muscular, skeletal & neural system.

## MUSCLES

Flagellar movement & Swimming of spermatozoa

Maintenance of water current in canal of sponges.

Locomotion of protozoan like Euklena.

Muscle → Mesodermal → 40-50% of body weight of adult

↳ special properties

contractility

elasticity

extensibility

excitability

NCERT THREAD NOTES

Muscle → classified → Location, appearance, nature of regulation.

Here, by Location → skeletal, visceral, cardiac



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Skeletal

Visceral

Cardiac

# NCERT THREAD NOTES

Associated with skeletal comp. of body

Inner walls of hollow visceral org.

Associated to heart

Striped / Striated

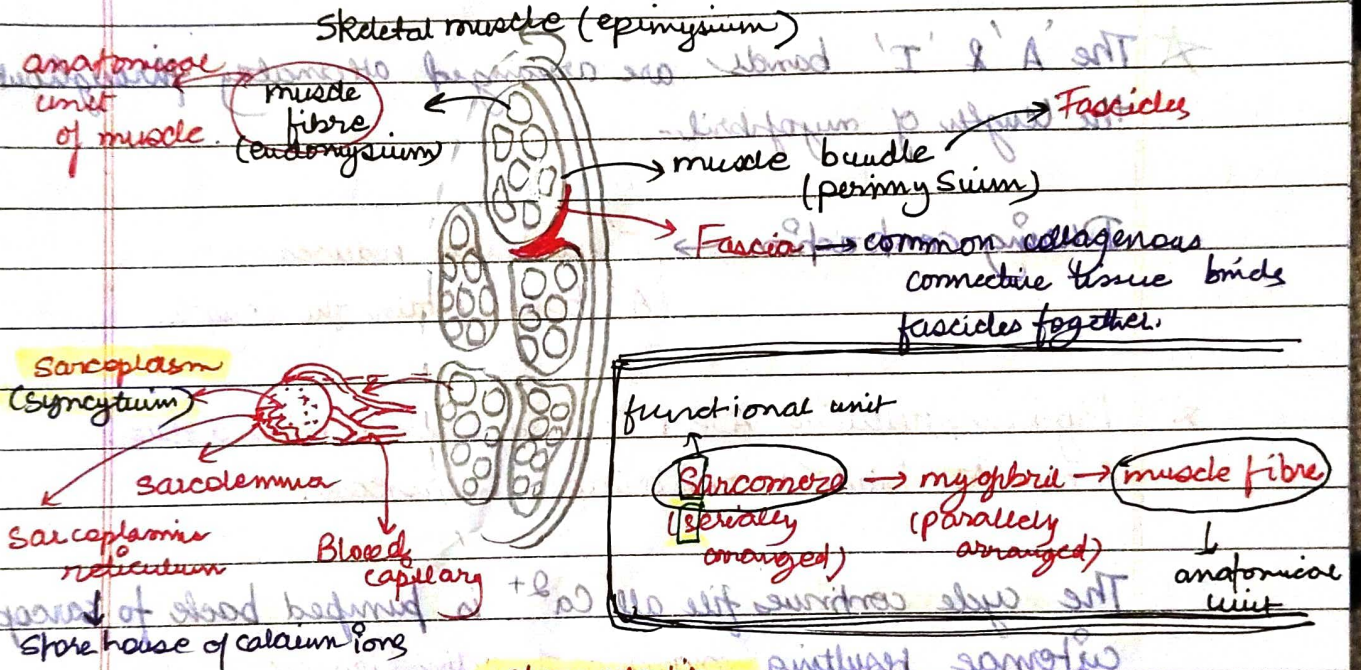
Unstriated

Branched / looks striped.

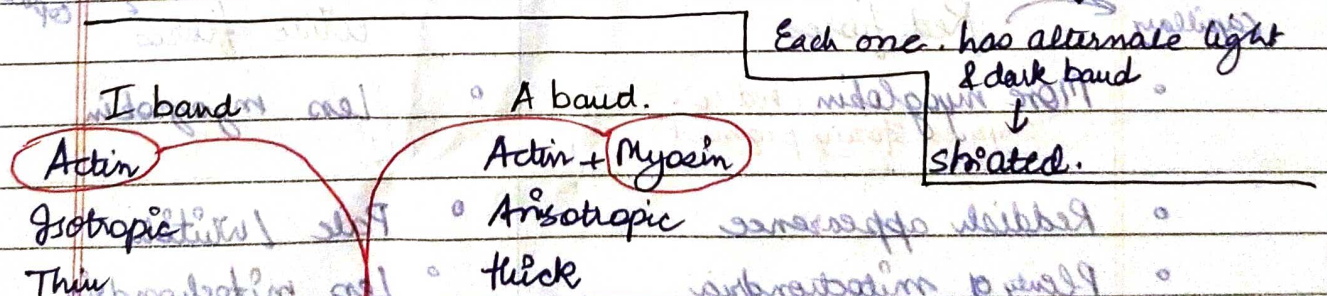
activity under direct control of CNS / Voluntary

Not under direct control of CNS / Involuntary

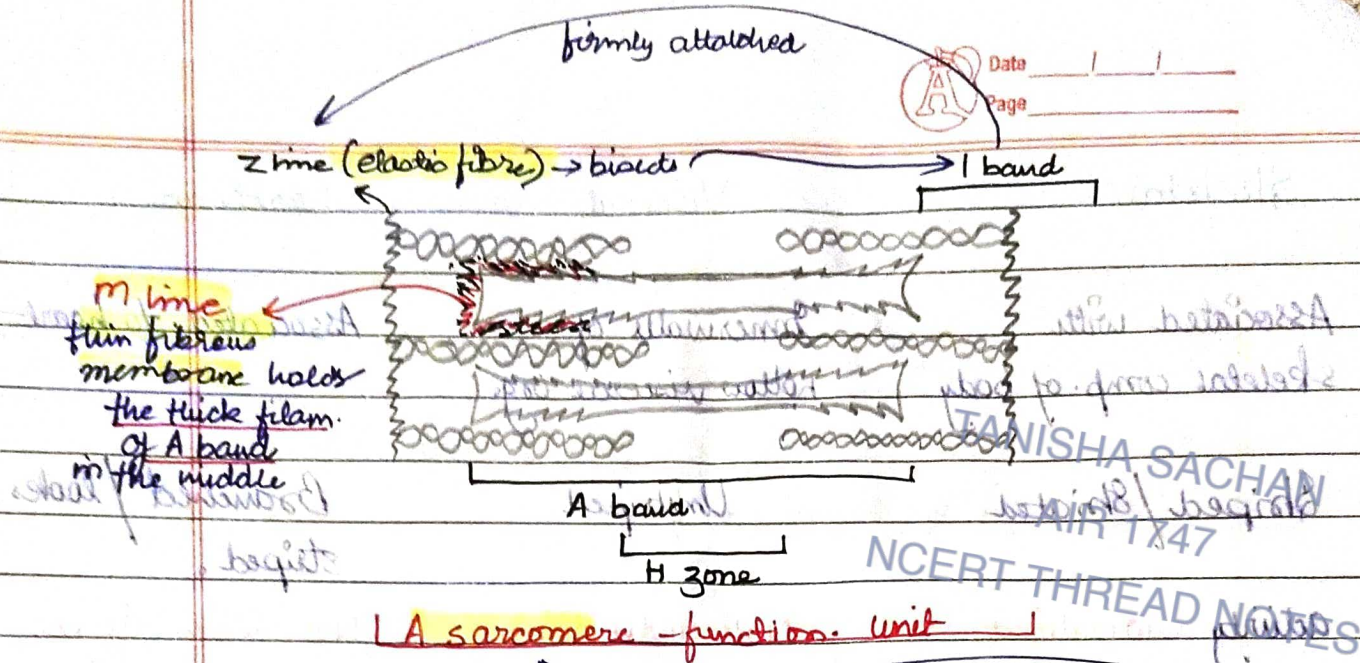
Not under direct control of CNS / Involuntary



A characteristic feature of muscle fibre is the presence of a large number of parallel arranged filaments of sarcoplasm called **myofibrils** / **myofibrils**.



Both proteins are arranged as rod like structures, parallel to each other & also to longitudinal axis of myofibrils.



The portion of myofibril b/w two successive Z line

★ The 'A' & 'I' bands are arranged alternately throughout the length of myofibril.

During contraction → 'I' bands get reduced  
'A' bands retain the length.

★ Myosin, releasing ADP & P<sub>i</sub>, goes back to relaxed state. (myosin)  
A new ATP binds & cross bridge is broken.

The cycle continues till all Ca<sup>2+</sup> is pumped back to sarcoplasmic cisternae resulting in masking of actin filaments.

→ The reaction time of fibres can vary in diff. muscles.

| Red fibres  | White fibres   |
|---|--|
| <ul style="list-style-type: none"> <li>more blood capillary</li> <li>More myoglobin (red col. oxygen storing pigment)</li> <li>Reddish appearance</li> <li>Plenty of mitochondria</li> <li>Large amt of O<sub>2</sub> for ATP product.</li> <li>Aerobic muscle</li> <li>Slow</li> <li>Long working</li> </ul> | <ul style="list-style-type: none"> <li>less blood capillary</li> <li>Less myoglobin</li> <li>Pale / white</li> <li>Less mitochondria</li> <li>Sarcoplasmic Reticulum is high</li> <li>Anaerobic</li> <li>Fast</li> <li>short time working</li> </ul> |



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# Structure Of Contractile protein →

## Actin

- (1) Two 'F' (filamentous) actins helically wound to each other.

Monomer 'G' (globular) actin

(+) → F (polymer) actin

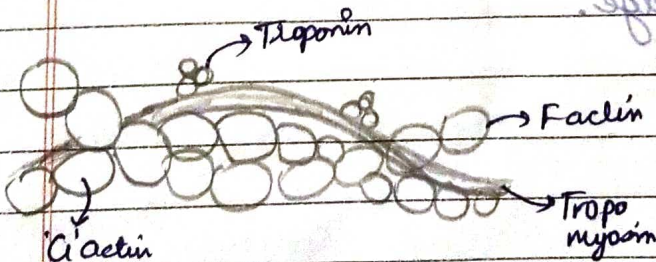
- (2) Two filaments of another protein tropomyosin run close to F actin throughout the length.

At Resting state

→ A subunit of tropomyosin (complex protein)

at regular intervals on tropomyosin

Marks the active binding sites for myosin on actin.



## Myosin

- (1) Polymerised protein

Monomer - meromyosin

Two parts.

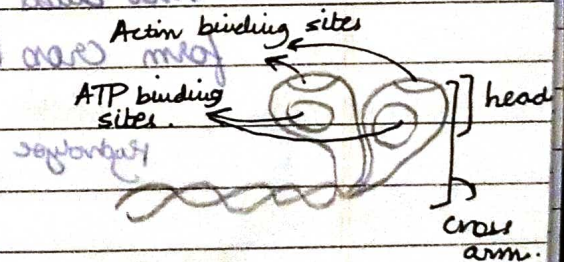
(1) Globular head, short arm (HMM)

(2) Tail (Lmm)

- (2) The head and short arm projects outward at regular intervals/distances & angle from each other from surface of polymerised myosin filament & is known as cross arm.

Head has - Active ATPase enzyme.

Active binding sites of actin.



# MECHANISM OF MUSCLE CONTRACTION:

## [Sliding Filament Theory]

Signal sent by CNS via motor neuron.

"motor neuron + muscle fibres → motor unit"

"The junction b/w motor neuron & sarcolemma of muscle fibre → neuromuscular junction / motor end plate"

Neural signal reaches the junction

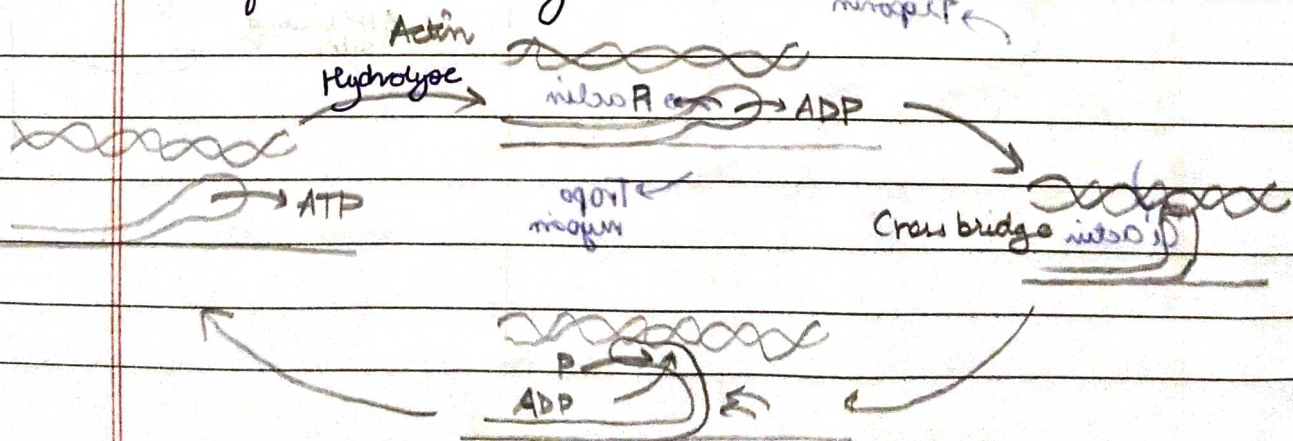
Acetylcholine releases (neurotransmitter) generates action potential in sarcolemma

Spreads through muscles & cause release of  $Ca^{2+}$  ions into sarcoplasm.

Increase in  $Ca^{2+}$  → Binding of  $Ca^{2+}$  to subunit of troponin on actin filament

Removes masking of active sites for myosin

Utilising energy from ATP hydrolysis, myosin head now binds to exposed active sites on actin to form cross bridge.



## Disorders of muscular & skeletal system:

- 1) Myasthenia Gravis : Auto immune disorder.  
Affects neuromuscular junction.  
Leads to fatigue, weakening & paralysis of skeletal muscles.  
*Progressive*
- 2) Muscular dystrophy : Degeneration of skeletal muscles.  
*Genetic disorder*
- 3) Osteoporosis : Age related disorder.  
Decreased bone mass (characterization)  
due to decreased level of estrogen (in females)  
Increased chances of fractures.
- 4) Tetany : Rapid spasm (wild contraction) in muscles.  
Due to low conc. of  $Ca^{2+}$  in body fluid.
- 5) Arthritis : Inflammation of Joints.
- 6) Gout : Inflammation of Joints.  
due to accumulation of uric acid crystals.

Joints :   
     → b/w bones  
     → b/w bones & cartilages

- Essential for the movement of bony parts. Locomotory movements are no exception to this.
- Force generated by muscles is carried out by joints acts as a fulcrum.



helps in locomotion & movement

## Fibrous Joints

## Cartilag. Joints

## Synovial Joints

- Doesn't allow any movement.

- Allows some mov. (limited)

- Allows movement nicely.

(considerable)  
Fluid filled synov. cavity b/w the articulating surf. of

- Ex: Flat skull bones

- Ex: B/w the adjac. vertebrae of vertebra

- Examples: two bones

joined end to end

vertebrae of vertebra

with dense fibrous

al column.

connective tissues form.

(Bones involved

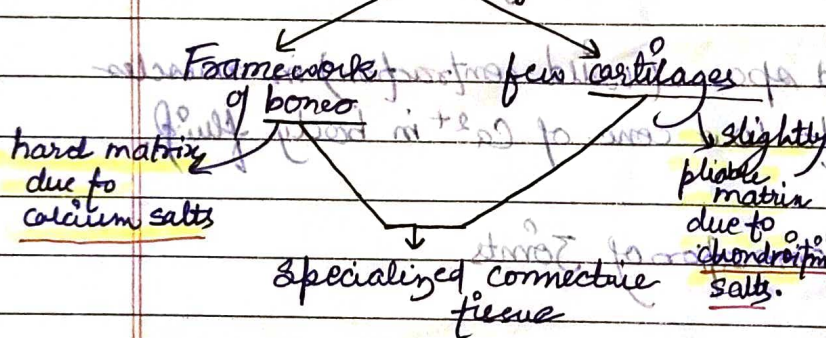
sutures, to form

are joined through

cranium

chondilage)

## Skeletal system



also b/w phalanges

Hinge joint

Knee & Elbow joint

Pivot joint

b/w atlas & axis

b/w radius & ulna

Saddle joint

b/w carpal & metac

carpal of thumb

Gliding joint

Carpals ke b/w

Ball & Socket joint

b/w humerus & pectoral

girdle, hip joint

(b/w pelvic girdle & femur)

## Skeletal system (206)

Apical (80)

(126) Appendicular

(Along main axis of body)

(The bones of limbs with their girdles)

Skull (29)

Ribs (24)

Verteb. Column (26)

Sternum (1)

Each limb has 30 bones (30 x 4)

The base of skull articulates with the superior region of the vertebral column with the help of two occipital condyles (di-condylic)

Cranial bon. (8)

Facial bones (14)

Ear ossicles (3 x 2) = 6

Hyoid bone (1)

U shaped bone at the base of buccal cavity

Pelvic bones (6)

S pectoral (4)

pelvic (2)



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NCERT THREAD NOTES

## Vertebral Column.

- 26 serially arranged.
- Extends from base of skull.
- Forms main trunk of the body.
- Placed dorsally.
- Each Vert. Column has units (Vertebrae).
- Each Vertebrae has a hollow canal through which Spinal cord passes.
- Cervical - 7, Thoracic - 12, lumbar - 5, sacral - 5 (fused - 1) Coccygeal (4) (fused - 1)

(2) Protects spinal cord.

(1) Supports the head.

- Serves as point of attachment for ribs & musculature of back.

Almost all the mammals have seven (7) cervical vertebrae.

Mantee - 6

2 toed sloth - 5 or 6

3 toed sloth - 9

- Sternum is ventrally placed at midline of thorax.

### Ribs

Ribs, thoracic vertebrae, sternum are called rib cage.

- 12 pairs

Each rib is thin flat bone attached dorsally to vertebral arch &amp; ventrally sternum.

It has two articulating surface on its dorsal end hence bicephalic.

Vertebrostermal/True Ribs

1st to 7th

Ventrally connected to sternum through hyaline cartilage

Vertebrochondral/false ribs

8th &amp; 9th &amp; 10th

Connected to 7th rib through hyaline cartilage

Floating ribs

11 &amp; 12th

Not connected to sternum



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## → Hands (fore limbs)

↓  
 Carpel - 8 (wrist bones)  
 Metacarpel - 5 (palm bones)  
 Phalanges - 14 (digits)

Humerus

Radius, Ulna

## → Legs (Hind Limb)

(ankle bones) Tarsals - 7

metatarsals - 5

phalanges - 14

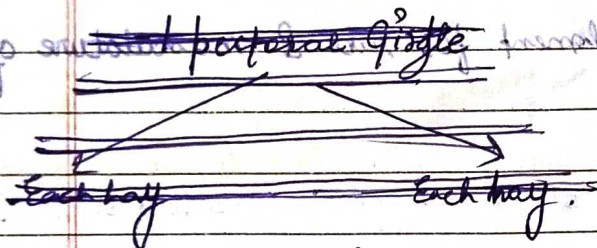
thigh bone

Femur - Largest bone

Tibia, fibula

A cup shaped bone patella  
 covers knee - knee cap.

## → Pectoral girdle (4)



- Each girdle is formed of two halves.
- Each half of pectoral girdle consists of a clavicle & a scapula.
- Scapula - large, Δ flat bone
- In Dorsal part of thorax b/w 2nd & 7th Ribs.

Scapula has slightly elevated ridge called the spine which projects as flat, expanded process called acromion. The clavicle articulates with this.

Below the acromion is a depression called glenoid cavity which articulates with head of humerus.

## → Pelvic girdle (2)

Consists of two conical bones

Each conical bone is formed by the fusion of ileum, ischium & pubis.

At the point above the fusion of bones is a cavity called acetabulum, to which thigh bone articulates.

The two halves of pelvic girdle meet ventrally to form pubic symphysis containing fibrous cartilage.

Each clavicle is a long slender bone with two curvatures. This bone is commonly called collar bone.